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EFFECT OF PRE-STORAGE TREATMENT ON THE SHELF-LIFE OF TIS 2 SWEET POTATO VARIETY

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ABSTRACT

The sweet potato (*Ipomoea batatas* L.) variety TIS 2 is a popular variety grown in Cape Coast metropolis. However, it is confronted with a myriad of post harvest challenges resulting from heavy losses (deterioration in storage). In this study the tuberous roots were pre-treated with four pre-storage treatments (Ash, Brine, *Lantana camara extract* and a Control) and stored at a temperature and relative humidity of 25^{o}C and 90 %, respectively. Using a completely randomized design (CRD), the tuberous roots were stored for twelve (12) weeks in an evaporative cooling barn. At the end of the storage, sweet potato roots pre-treated with the *Lantana camara* extract was the best with 90.7 % wholesomeness, 18 % weevil damage, 3.6 % shrinkage, 14 % weight loss and 19 % incidence of decay. The ash pre-storage treatment was most effective in reducing sprouting (42 %) as compared to the others. Pre-treatment of TIS 2 with *Lantana camara* extract may be explored to extend the shelf-life of sweet potatoes.

Keywords: sweet potato, pre-storage treatment, ash, brine, l*antana camara* extract.

INTRODUCTION

Sweet potato (*Ipomoea batatas* Lam.) is a herbaceous perennial and the edible portion is the tuberous root though the young leaves and shoots are eaten (Woolfe, 1992). The crop is now cultivated throughout the tropics and subtropics; it is ranked seventh among the most important crops worldwide (Scott, 1992; Zhitian *et al*., 2001). The ranking differs from country to country; in China it is ranked fourth as a food crop after rice, wheat and maize (Li *et al*., 1992) while in Sierra Leone, it is ranked third after rice and cassava (IAR, 2009).

In Ghana and other parts of tropical developing countries, sweet potato tuberous roots have storage duration of only up to three (3) weeks (Rees *et al*., 2003; Teye, 2010). However under controlled atmosphere (Temp. 13 -15^{o}C and RH of 90 %) the storage roots can be stored up to a year (Woolfe, 1992; Rees *et al*., 2003). In Ghana sweet potato production is currently being encouraged because of its numerous potential for food security. However, after harvest, the storage of the root is challenged by a myriad of problems which are often beyond the average farmer's control.

Despite the immense economic prospects that could be derived from its production and marketing, sweet potatoes is highly perishable. Its perishability arises mainly because of the thin delicate skin which easily gets damaged during harvesting and post harvest handling. This is also coupled with unfavourable environmental conditions and weevil damage in storage. Under this condition the roots express deterioration by sprouting, decay, shrinkage, weevil infestation and weight loss.

In the Cape Coast District, the production and marketing of TIS 2 sweet potato variety is a major income earner for a lot of farmers in places like Moree, Jukwa and Koforidua community. The rapid deterioration however, hardly gives the farmers room to exercise control over the marketing options like; when to sell, how much to sell and at what price. Hence during glut season farmers are often compelled to sell at 'giveaway' prices or harvest in smaller bits and sell. The latter practice is associated with high weevil infestation and it is a disincentive to large scale production of the crop. In this study we present data on the storage of TIS 2 sweet potato variety with various pre-storage treatments.

MATERIALS AND METHODS

The research was conducted at the Technology Village of the School of Agriculture, University of Cape Coast. After four months of cultivation of TIS 2 sweet potato variety, it was harvested and cured at a temperature and relative humidity of 30-33^{o}C and 90-96%, respectively (CIGR, 1999).

Treatments

Ash powder (suspected to be from *Cassia siamea*, C. Essoun, personal communication, May 2009). Ash is alkaline in nature and has insecticidal property. Research conducted by Mutandwa and Gadzirayi (2007) reported encouraging results for wood ash and soil. Sweet potato tuberous roots were packaged into sacks and dusted with ash powder sent into the shelves for examination.

Brine solution is known to be loathsome to most insect and microbes. It was prepared by mixing salt (Nacl) with water (H_2O) to a concentration of 1.2 M. The Sweet potato tuberous roots were dipped in the brine solution for 1 minute, air dried and sent to the shelves for further examination.

Lantana camara extract (Aqueous extract) is known to have insecticidal and biofungicidal property (Raman *et al*., 1997). It was selected because it has been found to reduce potato tuber moth in storage (Rajesh and Suman, 2006). In this study the leaves of *Lantana camara* were soaked in water overnight and later pounded to prepare aqueous extract. The sweet potato tuberous roots were dipped into the extract for 1 minute and then air-dried before it was sent to the shelf.

Control (No treatment) Equal numbers of sweet potato tuberous roots were package into sacks and sent into the shelf for examination.

The evaporative cooling barn

The evaporative cooling barn was built to maintain a controlled atmosphere. The relative humidity and temperature during the three month period of storage were 89-91 % and 24.6-25.3°C, respectively.

Experimental design and sampling procedure

In the evaporative cooler; a completely randomized design with three replications was used. Each replication had six sacks and each sack contained seven pre-treated sweet potato tuberous roots. For the six sacks, one sack was randomly sampled every 2 weeks for destructive analysis. The data collected were:

a) Weight loss/shrinkage
b) Weevil damage
c) Sprouting
d) Decay (Incidence of decay)
e) Wholesomeness

RESULTS AND DISCUSSIONS

a) Weight loss/shrinkage

Figure-1a shows that significant differences in weight loss existed among the pre-storage treatments applied. However, there was no significant difference between *L. camara* extract and the control. Rees *et al.*, (2003) reported that loss in weight of sweet potato in storage is inevitable though it can be reduced. This finding also revealed that the evaporative cooler and *L. camara* extract combine synergistically to minimize weight loss below 15 % after 12 weeks of storage.

Figure-1b shows that there were significant differences in shrinkage between all the pre-storage treatments applied. *L. camara* extract had the lowest shrinkage in storage. Shrinkage is as a result of water loss. This renders the roots less turgid and liable to cell collapse. Furthermore it was observed that shrinkage increased over time duration which revealed that the initial shrinkage was as a result of transpiration of moisture from the surface layers, then followed by movement of moisture towards the surface for further transpiration leading to gradual collapse hence shrinkage of the tuberous root.

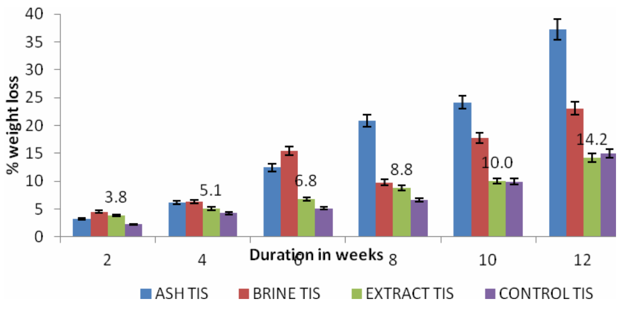

Figure-1a. Percentage weight loss versus weeks after pre-treatment application showing Lsd (p = 5%).

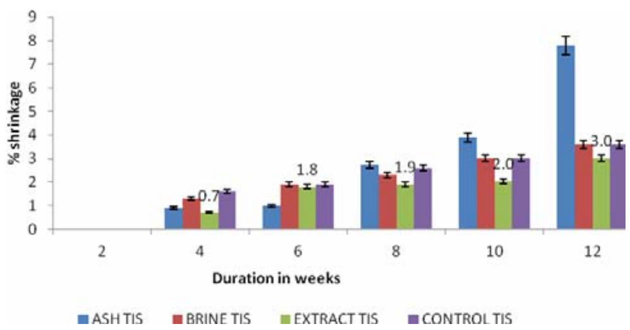

Figure-1b. Percentage shrinkage versus weeks after pre-treatment application showing Lsd (p = 5%).

b) Weevil damage

Figure-2 shows that significant differences occurred for the pre-storage treatments applied. However for six weeks in storage weevil damage was not observed for all pre-treatments applied. But after eight weeks to twelve weeks of storage *L. camara* extract significantly reduced weevil damage in storage. This could be attributed to the insecticidal property found in the *L. camara* extract that was efficacious to weevil in storage. Furthermore similar researchers have proven that *L. camara* extract can control insect pest (Raman *et al.*, 1997; Sagoe, 2003; Rajesh and Suman 2006).

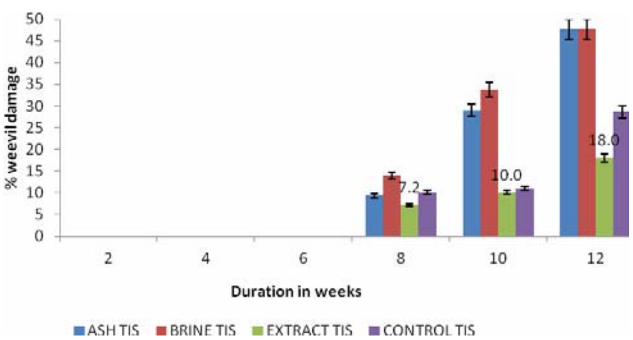

Figure-2. Percentage weevil damage versus weeks after pre-treatment application showing Lsd (p=5%).

c) Sprouting

Figure-3 shows that sprouting of the sweet potato tuberous roots started after six weeks of storage and when it started there were differences. However for Ash sprouting was after eight weeks in storage. After twelve weeks in storage, sprouting for control and *L. camara* extract was the highest close to 100%; it could mean that control and *L. camara extract* had no effect on cell potency or viability of the sweet potatoes. Furthermore though sprouting in storage is an undesirable phenomenon the lower sprouting observed in storage for sweet potatoes pre-treated with Ash and Brine is not an indication that it reduced the potency or viability of the sweet potatoes but rather there was a higher deterioration of the sweet potatoes. Hence no roots left for sprouting.

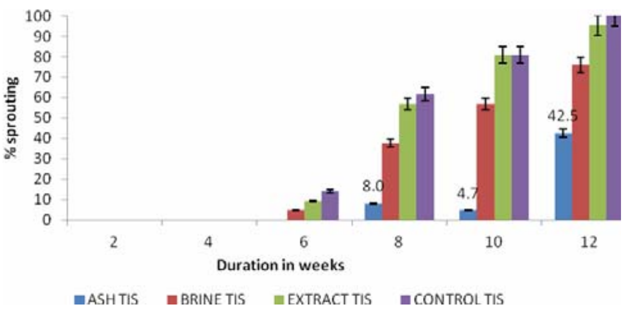

Figure-3. Percentage sprouting versus weeks after pre-treatment application showing Lsd (p = 5%).

d) Decay

Incidence of decay

Figure-4 shows the presence of decay observed among the pre-treatments applied. Significant differences occurred from two weeks to twelve weeks. In all *L. camara* extract significantly reduced incidence of decay in storage. Most especially decay was not seen in the first six weeks of storage. This re-affirms the effectiveness of *Lantana camara* against pathogens as observed by Srivastava, (1997); Ross (1999); Rajesh and Suman (2006). Sweet potato tuberous roots pre-treated with brine and ash decayed most reflecting subsequently on their lower sprouting ability and unwholesomeness.

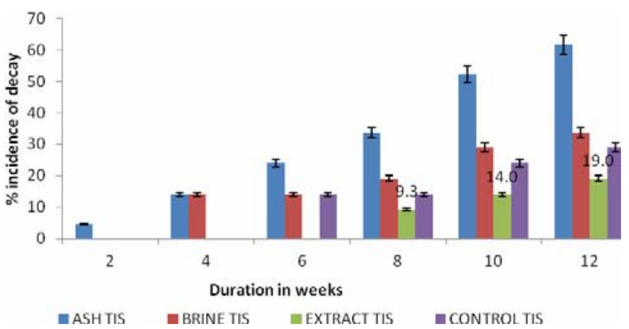

Figure-4. Percentage incidence of decay versus weeks after pre-treatment application showing Lsd (p = 5%).

e) Wholesomeness

Figure-5 shows that for the first six weeks there were no significant differences in wholesomeness for the pre-treatments. However after twelve weeks of storage *L. camara* extract had the highest percentage wholesomeness which was highly significant among the pre-storage treatments used. It revealed that *L. camara* extract offered resistance to general deterioration of the sweet potato tuberous roots. This finding further proves that *L. camara* extract contains an active ingredient lantadene A and B (Pan *et al*., 1997) which causes hepatoxicity (Sharma and Sharma, 1989) and has anti-microbial and immune suppressive property (Ross, 1997).

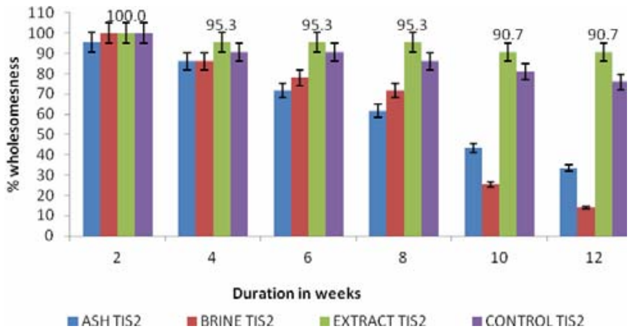

Figure-5. Percentage wholesomeness versus weeks after pre-treatment application showing Lsd (p = 5%).

CONCLUSIONS

Lantana camara extract pre-storage treatment was better than the other pre-storage treatments in reducing weevil damage, weight loss, decay and shrinkage in storage, also it had the highest percentage wholesomeness at the end of twelve weeks in storage.

Ash and Brine pre-storage treatments reduced sprouting better during storage than the other pre-treatments. However this was because most of the sweet potato tuberous roots pre-treated with Ash and Brine decayed severely in storage.

It is possible to store TIS 2 sweet potato tuberous roots pre-treated with *Lantana camara* extract for 10-12 with 10-18% weevil damage and 90% wholesome tuberous roots.

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